THE FLORA OF PENIKESE ISLAND: THE CENTENNIAL COLLECTION AND ITS BIOGEOGRAPHIC IMPLICATIONS

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The flora of Penikese Island has been studied more extensively than that of any comparable area on the eastern coast of North America. Complete lists of vascular plant species on the island were compiled in 1873 by D. S. Jordan, while an instructor at the Anderson School of Natural History, in 1923 by J. M. Fogg, Jr. (in Lewis, 1924) and in 1947 by E. T. Moul. These latter two collections were made in part by groups commemorating 50th and 75th anniversaries of the Anderson school. Fogg (1930) included Penikese in a larger study of the Elizabeth Islands, listing a number of species not encountered in the 1923 collection. The present study is a flora of the vascular plants occurring on Penikese in 1973 and a comparison of this flora with that in 1873, 1923, and 1947, using recent biogeographic methods, with observations on vegetational changes which have occurred on the island over the last 100 years.

Penikese forms part of the Elizabeth Islands chain and lies at 41°27′ N. latitude, 70°55′ W. longitude, one mile north of Cuttyhunk, the lowermost island of the group, and about 12 miles southwest of Woods Hole, Massachusetts. The island was formed during the last, or Two Creeks, substage of the Wisconsin glaciation, and now consists of two morainal hills joined by a narrow isthmus, totalling about 74 acres in extent with the highest point 86 feet above sea level (Kalisch, 1972). Zinn and Kahn (1972) discuss its geology in some detail. There are no streams and little evidence of dune formation or significant wind erosion, although Penikese is exposed to winds from all directions. The beaches except for a sandy strip on the eastern margin of the isthmus are littered with boulders or rocks of various sizes which impede further erosive actions of wind and water. Eight ponds occur,

one of which, Typha Pond, probably occupies an original kettlehole, the other seven being situated in marked depressions or formed by the coalescing of beaches.

The earliest description of Penikese was written following Gosnold's exploration of the island on May 30, 1602. Gosnold logged cedars, "some of which would make masts for the greatest ships of the world" as well as sassafras (in Gookin and Barbour, 1963). From 1602 to 1873, the island was bought and sold several times, supporting up to three families at any given period. An account of its history is in Howland (1964). In 1873, John Anderson offered Professor Louis Agassiz the island to be used as the site for a school for the instruction of teachers of natural history; construction of the school began that spring. Jordan (1874) described Penikese in 1873 as without trees, nearly without shrubs, scantily covered with pasture grasses, and "about as barren looking a pile of rock and stone as one could well imagine." Of the previous woodlands, only "the rotten roots of a solitary beech stump and a few branches of red cedar and red maple (?) found buried in the muck of a small swamp" remained. The island was heavily grazed by sheep and had been grazed at least since 1797. In addition an estimated 1,000 nesting terns were present (Nisbet, 1973). Jordan collected 108 species of vascular plants from Penikese, all of which were common on the surrounding mainland. Some prominent mainland taxa, including the genera *Aster* and *Solidago*, were then absent from the island.[1]

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[1]Jordan also collected on Gull Island, a small island one half mile southeast of Penikese, listing several species including *Lathyrus japonicus*, *Limonium carolinianum*, *Rhus radicans*, and *Solidago sempervirens*, then absent from Penikese. Lewis (1924) described this island, then connected to Penikese at dead low water, in some detail, and Fogg (1930) noted species, including *Rhus radicans* and *Limonium carolinianum*, which had also disappeared from Gull Island. Gull Island was used as a target for bombing practice during the 1947 collecting period and Moul, because of government regulations, was not allowed to visit it. By summer, 1973, Gull Island, devoid of terrestrial vegetation, appeared as a pile of rocks probably under water at high tide.

The Anderson School closed after the summer of 1874 and the island remained uninhabited for about ten years, after which it was resold and used to support a turkey farm and continued grazing by sheep. In 1905, the State of Massachusetts acquired the island to use for isolating smallpox patients and, later, as a leprosarium. Tern populations increased rapidly following protection to an estimated 7,000 birds in 1908. In 1921, the leprosarium was discontinued and the island again abandoned.

In 1923, a plaque commemorating the founding of the Anderson School was fixed to a boulder on the larger of the hills. A biological survey was conducted (Lewis, 1924) during which Fogg listed 166 species of vascular plants present while ecological observations were compiled by Margaret Shaw. The island had been uninhabited for two years; sheep had been removed and grasses were abundant. *Ammophila breviligulata* covered the slopes of the west shore; areas in the northern grasslands were denuded by terns (*Sterna hirundo* and *S. Dougallii*) which nested there in June. Some woody species, including *Rhus typhina*, *Sambucus canadensis*, *Myrica pensylvanica*, and one specimen of *Quercus rubra* had invaded. Species of *Aster* and *Solidago* were well established in the grasslands. The increase (58) in total species since 1873 may be explained in part by changes in land use, including the abolition of grazing, the accidental introduction of weed species, and the deliberate introduction of persistent ornamentals and vegetables.

During summer, 1923, most of the ponds showed marked zonation with floating algae surrounded by a zone of sedges (including *Eleocharis obtusa*, *E. palustris*, *Scirpus americanus*, and *S. paludosus*), a band of *Spartina patens*, and an irregular band of *Iris versicolor* adjacent to the grasslands. Typha Pond was surrounded by concentric zones of *Typha latifolia*, *Juncus acuminatus*, and, adjacent to the grasslands, *Scirpus paludosus*. *Salix alba* × *fragilis* occurred at both ends of the pond. On the northwestern portion of the larger section of the island, the ponds were

more shallow and surrounded by large stands of *Bidens connata*. Dry Pond had apparently contained water in the spring but was dry in August and lacked vascular plant species; Tern Pond was surrounded by a zone of *Spartina alterniflora* and *Dryopteris thelypteris*.

During the period 1924 to 1930, Fogg made additional trips to Penikese, collecting more than 20 previously unreported species. In 1925, much of the leprosarium was demolished and the island was transferred to the Massachusetts Division of Fisheries and Game for use as a bird sanctuary. Various game species were introduced along with a variety of plants intended as food for wildlife. The breeding population of terns increased through 1932, suffering an abrupt decline that year for reasons which are largely unexplained (Floyd, 1932). In 1933, breeding herring gulls (*Larus argentatus*) were first observed on Penikese (Floyd, 1933). From 1925 through 1939, one or more caretakers were resident on the island; from 1939 through 1973, no-one has resided there year-round.

During summer, 1947, E. T. Moul collected 158 species of vascular plants on Penikese. He noted little change in the vegetation since 1923. Dominant species of the tension line and grassland communities were the same; many of the escaped cultivated species had not persisted, however, perhaps because of the several hurricanes which had drenched the island with salt spray. *Rhus radicans*, previously absent, occurred in stunted form in the high grasslands. Thickets of *Sambucus canadensis* had increased in size and number, particularly along stone walls and in depressions. Seven clumps of *Morus alba*, previously unreported, were well established on the hill behind Tub Pond. Trees and shrubs in more exposed habitats did not appear to have increased in size or number. Terns were variously estimated at 2,500 and 10,000 birds (Nisbet, 1973) and nested over much of the island. Herring gulls were estimated at 2,000 birds (Zinn and Rankin, 1952).

The vegetation around the ponds was similar to that in 1923 as well. Typha Pond had the richest, most diversified

flora; the willows previously found nearby had been, however, cut. Dry Pond was unchanged, though some water may have been present earlier in the year. Leper and Tern Ponds were dry in early July; these were no longer surrounded by *Bidens connata*, but supported large stands of *Polygonum punctatum* and *Rumex maritimus*. South and Tub Ponds were brackish with characteristic halophiles surrounding them. The marsh on the east shore had a flora similar to that of Typha Pond, a change from its previous brackish condition.

Moul made one trip to Penikese in 1961. *Daucus carota*, *Datura stramonium*, and *Chrysanthemum leucanthemum*, previously very common, were then rare. The island apparently had been overrun by gulls in the late 1950's (Nisbet, 1973); breeding terns were absent. A number of shrubs, including *Rhus copallina*, *Rubus laciniatus*, and *Sambucus canadensis*, had spread. *Pinus sylvestris* had become extinct, while specimens of *Acer pseudoplatanus*, thickets of *Populus alba*, none more than five feet tall, and a single specimen of *Populus deltoides*, badly salt-spray-damaged, remained. Two ferns, *Dennstaedtia punctilobula* and *Dryopteris thelypteris* were absent from their former sites, while *Raphanus raphanistrum*, previously restricted, was established in large pure stands (Moul, 1961).

By summer, 1973, Penikese had lacked a resident human population for 44 years. A large breeding colony of herring gulls and black-backed gulls (*Larus marinus*) was present; no nesting terns were seen. On the north side of the island, an old stone dock, presumably built prior to the founding of the Anderson School, remains in fairly good condition. Behind the dock are a series of foundations and stone walls. Near the summit of the hill on which the commemoration plaque for the Anderson School is fixed is a small reservoir, still holding water, and the foundation of a smaller similar structure. On the west side of the larger portion of the island, foundations of the leper cottages are still visible. One small cement building stands at the northeast end of the row of cottages; eastward

behind the cottages is a small cemetery. There are no signs of previous human habitation on the smaller portion of the island.

In June, all of the ponds except Dry Pond held water; by July 14, water level had fallen markedly. On August 8, Rankin Pond, formed within the last 26 years to the northeast of Tern Pond, was completely dry and Leper Pond was nearly so. Water level in the marsh had dropped considerably.

By August 8, most of the gulls had left the island. There were two campsites present at this time, one of the occupants claiming to have camped on Penikese for six weeks each summer for the last ten years. Earlier in 1973, the island was subcontracted to the State Department of Youth Services to be used in part for a school for problem youths. By September the building of this facility had begun and a temporary campsite was constructed. A small tractor hauled equipment from the dock up to the site of the school, enlarging what had been for at least 100 years a footpath.

For the purposes of this study, seven trips were made to Penikese in summer, 1973, on the following dates: June 12, July 14 and 15, August 8, 9 and 13, and September 20. Specimens of 163 vascular plant species were collected in identifiable condition. The grasslands, quite thick over most of the island, contain denuded areas and numerous paths made by the gulls. *Rumex acetosella* frequently dominates gull nesting sites. Dominant grasses are *Ammophila breviligulata* on the southeast side, *Agrostis stolonifera* in clumps around the ponds, *Holcus lanatus* on the west side of the island, and *Agrostis tenuis*, *Anthoxanthum odoratum* and *Poa pratensis* throughout. Thick patches of *Solidago sempervirens*, *S. rugosa*, and *S. tenuifolia* are scattered across the larger hill. *Chrysanthemum leucanthemum* is again abundant, particularly on the smaller section with *Achillea millefolium; Daucus carota* remains, as in 1961, extremely scarce. A single specimen of *Dennstaedtia punctilobula* was noted; *Datura stramonium* is again common, particularly in the tension line.

Over the last 26 years, there has been a marked increase of shrubs and woody vines. *Rhus radicans* occurs in dense patches in the upper grasslands on the main portion of the sland, and *R. copallina* is well established in grasslands behind the wharf, with a small stand on the western side. *Rosa rugosa*, reported previously only on the east side of the main portion of the island near the dock, is now well established over the main portion and borders South, Typha, and Leper Ponds and the marsh. A thick patch occurs near the wharf. *Rhus typhina* and *Myrica pensylvanica*, found in 1923 and 1947 in only one location each, are well distributed over the larger hill.

Penikese has no clearly defined zones resulting from the effects of wind-borne salt spray, as do other nearby coastal areas (Boyce, 1954). The "tension line" is that portion of land between the beach and areas supporting grasslands and on Penikese is underlain largely by eroded glacial deposits. Plants common to this zone in 1973 include *Rumex crispus, Phytolacca americana, Mollugo verticillata, Glaucium flavum, Lepidium virginicum, Raphanus raphanistrum, Lathyrus japonicus, Anagallis arvensis, Lycopersicum esculentum, Solanum dulcamara, S. nigrum, Verbascum thapsus, Matricaria matricarioides,* and *Sonchus asper*. Halophytes, including the widespread and often frequent *Cakile edentula*, are rare.

Typha Pond no longer contains *Typha latifolia*, which now occurs only in one small stand within the marsh, the salinity of which has dropped off steadily since 1947 (Zinn and Rankin, 1947; Rich, 1973). Typha Pond has not become more saline than in previous years and the extinction of *T. latifolia* there cannot be easily explained. The pond is surrounded by *Agrostis stolonifera, Panicum virgatum, Rosa rugosa*, scattered *Polygonum punctatum*, and *Aster novi-belgii*.

The change from salt to fresh water in the marsh may have caused the loss of salt marsh species noted in previous collections. Jordan collected *Iva frutescens, Salicornia europaea, Suaeda maritima, Spartina patens*, and *S. alterni-*

flora there. Fogg and Moul collected only the two Spartinas. In 1973, *Polygonum punctatum* and *Pluchea purpurascens* are abundant on the edges of the marsh; *Iris versicolor* is common on the northern end with a clump of *Rosa rugosa*. *Solidago sempervirens* and *Sambucus canadensis* grow among thick clumps of *Agrostis stolonifera*; *Juncus gerardi* is scattered at intervals along the edge.

Dry Pond supports large stands of various grasses, *Polygonum persicaria*, *Rubus frondosus*, *Sambucus canadensis* and *Solidago rugosa*. There was no evidence that the pond held water earlier in the spring. The zonation surrounding other freshwater ponds in 1923 and 1947 is no longer present. Many freshwater marsh plants, including *Eleocharis palustris*, *Scirpus americanus*, *S. paludosus*, and *S. validus*, apparently became extinct sometime after 1947. The presence of numerous herring gulls resting within these ponds may have contributed to the elimination of these species.

Tern Pond is surrounded by grasses with scattered *Iris versicolor*, *Polygonum persicaria*, *P. punctatum*, *Phytolacca americana*, *Solidago rugosa*, and *S. sempervirens*. *Ludwigia palustris*, *Myriophyllum verticillatum*, and *M. pinnatum* were collected in dried mud and in shallow water on its bottom.

Leper Pond is surrounded on the east and southeast sides by *Agrostis stolonifera*, *Phytolacca americana*, and *Solidago sempervirens* and by *Rhus typhina* and a small grove of *Salix alba* × *fragilis* on the west and southwest. *Ludwigia palustris* is abundant on the bottom. Only low grasses border the northeast, most-exposed end.

South Pond, the largest pond on the island, with Tub Pond is most exposed to wind-borne salt spray. *Iris versicolor* and *Rosa rugosa* are scattered along the northwestern edge; *I. versicolor* and *Panicum virgatum* dominate the northeastern border. The southern end is rocky with interspersed tension line species.

Tub Pond, located on the smaller section of the island, is separated from the ocean on the east, west, and south

sides by only a short rocky beach. A cliff to the north is covered chiefly by *Agrostis tenuis*, *Panicum virgatum*, *Achillea millefolium*, and *Solidago sempervirens*. Tension line plants, including *Phytolacca americana*, *Anagallis arvensis*, and *Solanum dulcamara*, are dispersed among the rocks along its edge. The salinity of the pond increased from 9 o/oo to 34.4 o/oo during the period 1923 to 1947 (Zinn and Rankin, 1952); the pond lacked submerged macrophytes in 1973.

Rankin Pond is surrounded by grasses, *Polygonum persicaria*, and *Solidago sempervirens*.

Several plants new to Penikese in this collection were quite abundant during summer, 1973. *Glaucium flavum* is the dominant species, represented by hundreds of individual plants, on the rocky isthmus between the two portions of the island and is also found in the tension line on the south side of the island below South Pond. Seymour (1969) reports this species as rare on shores in Bristol County and on Naushon Island, Massachusetts, while Hehre and Conway (1969) reported three colonies, totalling 20 plants in all, in West Falmouth, Mass. *Matricaria matricarioides* is abundant on the tension line on the southwest side of the larger section of the island, below the old leper cottages, and in the tension line on the southwest side of the smaller portion of the island. New escapees from cultivation, aside from the tomato, are muskmelon, *Cucurbita melo*, in a depression near Tub Pond and English ivy, *Hedera helix*, the flowering form of which was found near the old leper colony foundations on the southwest shore.

BIOGEOGRAPHIC CONSIDERATIONS

Two themes have recurred in discussions of the flora and vegetation of Penikese and other islands, the problem of successional development of the vegetation and the interpretations of differences between successive plant lists. Jordan (1874) felt that his list might be of general

interest "as showing which plants survive a prolonged struggle against grass and sheep." Shaw (in Lewis, 1924) suggested that on Penikese, forest might "again develop provided the land is neither pastured or cultivated." Lewis in the same paper, noted that "ecologically the island is progressing rapidly" in the 12 years without sheep and postulated that man was the most efficient agent for the introduction of new species. Fogg (1930), in a detailed analysis of invasions since 1873, by his reckoning about 20 garden escapes, an equal number of cosmopolitan adventives, and over 50 native species, raised the difficulty of understanding why so many invaders since 1873 "should have been kept down until recent times when so many others were not only present in 1873 but have survived . . ."

Moul (1948), noting that the general aspect of the vegetation had not changed for 24 years, suggested that the flora consisted of two groups of species, one adapted to the ecological conditions of the island, the other consisting of colonists which were periodically wiped out. In 1961, noting the decrease in tree populations and the extinction of *Pinus sylvestris* on Penikese since 1947, he concluded that "the evidence indicates a grass 'subclimax' may persist indefinitely."

An interesting dimension to the problem of island diversity was added by Preston (1962) and MacArthur and Wilson (1963) who suggested that on oceanic islands a balance of immigration by extinction might exist so that the diversity of at least some biotas might be understood as an equilibrium. This theory, developed more fully in MacArthur and Wilson (1967), postulates that during early successional stages the rate of extinction will tend to decrease in areas of sufficiently varied topography, permitting an increase in the total flora. Penikese is, of course, a land bridge or continental island, separated from the mainland during the last rise in sea level. MacArthur (1972) suggests that small land bridge islands experience initially high extinction rates when separated from the mainland and rapidly reach equilibrium in the manner of

Table 1. Total flora at each collection period, invasions, re-invasions, extinctions, and persisting species.

Collections	Number of species
1873	108
1923	166
persistent since 1873	70
extinctions since 1873	38
invasions since 1873	96
1947	158
persistent since 1873	55
persistent since 1923	59
extinctions since 1923	52
invasions	
invasions since 1923	35
re-invasions from 1873 flora	9
1973	163
persistent since 1873	47
persistent since 1923	45
persistent since 1947	18
extinctions since 1947	48
invasions	
invasions since 1947	34
re-invasions from 1873 flora (went extinct by 1923)	5
re-invasions from 1923 flora (went extinct by 1947)	14

oceanic islands. The history of the flora of Penikese appears to be a striking corroboration of the equilibrium concept. Table 1 contains the total number of vascular plant species present at each collection period, as well as invasions, re-invasions, extinctions, and persisting species. The total number of species in the floras in 1923, 1947, and 1973 varies within a range of only eight species. The

marked increase after 1873 can easily be explained by changes in land use, particularly the elimination of grazing sheep, which permitted some successional development within that period. Extinctions from each flora apparently occur abruptly and then less drastically in successive collections, supporting Moul's separation of the flora into permanent and temporary elements. Species lost from the 1873 flora were 38 by 1923, 15 between 1923 and 1947, and 8 between 1947 and 1973, excluding re-invasions in the latter instances. Similarly the loss from the 1923 flora was 52 during the period 1923-47 and 22 between 1947 and 1973.

Table 2. The Simpson Index of Resemblance comparing all collections at the specific level.

Time Interval (years)	Collections compared	Resemblance
100	1873-1973	60.2
74	1873-1947	59.2
50	1873-1923	64.4
50	1923-1973	65.0
24	1923-1947	72.0
26	1947-1973	71.0

We have used the Simpson index of resemblance (Simpson, 1965) to compare the taxonomic composition of the floras at each collection period. This index ($100c/_{n1}$ in which c is the number of taxonomic units common to the two floras and n_1 the total number of units in the smaller of the two) seems particularly useful in comparing floras of approximately equal numbers occurring in a single area. Changes in the floristic composition of successive floras seem to have occurred in a quite even manner (Table 2). Although, as would be expected, floras most distant in time are most dissimilar, the resemblances throughout the 50 year intervals 1873-1923, 1923-1973 or the shorter periods 1923-1947, 1947-1973 are remarkably alike.

We have also compared the ratios of non-native to native species in the various floras (Table 3); these ratios have declined since the 1873 collection, when non-natives outnumbered native species, increasing slightly between 1947 and 1973. They have remained throughout the period strikingly higher than those of adjacent coastal areas (Burk, 1968). The overall decline in non-natives since 1873 may be attributed to decreasing disturbance on the island as well as to the larger pool of native species available for colonization in surrounding areas. The latter increase may well be attributed to the action of the herring gulls, which forage in mainland dumpsites where non-native species are abundant, as agents of dispersal.

Table 3. Number of native and non-native species in successive floras and the ratio non-native/native species.

Collection	Native species	Non-native species	Ratio non-native/native
1873	53	55	1.04
1923	87	79	.91
1947	91	67	.74
1973	87	76	.87

Pike and Hodgdon (1962), evaluating changes in the flora of Machias Seal Island over an 18 year period, raise the problem of what constitutes a definitive flora in areas where striking changes in floristic composition occur rapidly. Island biotas are increasingly interesting for practical as well as theoretical reasons (Kolata, 1974; Willis, 1974); we suggest that for maximum utility, two different kinds of island floras must be maintained, compendia of all species ever collected (on Penikese this would number over 280) and a series of lists of species present during clearly delimited, relatively short intervals of time.

A reconnaissance of Penikese on July 9, 1974, suggests further explanations of recent changes in the vegetation

and hints at what may be anticipated there. The drought of the early 1960's may have contributed to the elimination of zonation in the ponds. The 1974 season to date had been much drier than 1973, and Typha Pond was lower than at any time the previous season. *Scirpus americanus*, not seen in several careful surveys of the pond during 1973, was fairly abundant on the muddy stratum below what had been low water mark that year. These plants were severely cropped by gulls; in addition clumps of grasses at the edges of the pond showed the effects of heavy grazing by muskrats. All ponds on the west side of the island were already dry, including Tern Pond, which held water through the year before; the pond bottoms were already invaded by a variety of herbs including *Polygonum* spp. *Rumex crispus*, *Ludwigia palustris*, *Anagalis arvensis*, *Gnaphalium uliginosum*, and *Pluchea purpurascens*. Vegetation generally throughout the island was less lush than in 1973. In addition, since the previous autumn several buildings had been constructed on the east side near the dock; a large vegetable garden had been laid out, and the reservoirs were being cleaned and repaired. The period of no year-round human activity on the island has clearly ended and new patterns of disruption, with concomitant invasions and extinctions, may be predicted with assurance.

THE 1973 FLORA

The following lists are based on Moul's compilation of the 1947 Penikese flora (Moul, 1948); species found in both 1947 and 1973 are not repeated. Invasions since 1947 comprise three categories: (1) elements new to Penikese since 1947, (2) re-invasive elements not collected since 1923, and (3) re-invasive elements not collected since 1873. These three groups of species are listed with their habitats in 1973. Those species represented in the 1947 collection but not found in 1973 are listed without habitats; hence future students of the flora will be able, with the aid of this and previous plant lists, to compile a total flora

and to make the sorts of biogeographic comparisons between floras which we have presented earlier. Nomenclature is based on Fernald (1950) unless otherwise noted; the order of the list follows Fernald (1950) for families, treating genera within families and species within genera strictly alphabetically.

Lewis (1920) and later Fogg (1930) in more detail attempted to equate certain species in Jordan's list and absent from the island in 1923 with species present at the latter period. Stuckey and Phillips (1970) accept Lewis's 1924 suggestion and consider Jordan's report of *Lycopus europaeus* on Penikese misleading, citing nonetheless valid reports of *L. europaeus* introduced with ballast in Massachusetts in the late 19th Century. Jordan did not keep voucher specimens and his *Cerastium viscosum* may indeed have been *C. vulgatum*, his *Lycopus europaeus*, *L. americanus*, etc. Nonetheless, we have encountered five species of vascular plants collected previously only by Jordan, and for the purposes of this listing and in the previous biogeographic computations, have preferred to accept Jordan's identifications at face value, allowing of course for taxonomic revisions and corrections of synonymy. In addition to the 163 species listed, specimens of five other taxa were collected in unidentifiable condition.

All specimens collected in this study have been deposited in the herbarium of Smith College.

Species new to Penikese since 1947:

Distichlis spicata — grasslands behind the marsh
Festuca capillata — grasslands on the west side of the larger section
Panicum clandestinum — around South Pond
Panicum dichotomiflorum — common around Tub Pond
Panicum lanuginosum — rare around Typha Pond
Cyperus erythrorhizos — shore of Typha Pond
Sisyrinchium atlanticum — around Tub Pond

Polygonum pensylvanicum — grasslands near old foundations on the west shore and scattered in depressions on the larger section

Chenopodium ambrosioides — scattered in the tension line on the east side of the larger section

Chenopodium lanceolatum — tension line, just below the grasslands on the west side of the larger section

Chenopodium pumilio (in Gleason, 1952) — tension line on east side of the larger section in the area of South Pond

Ranunculus bulbosus — rare, scattered throughout grasslands

Glaucium flavum — common on the causeway and in the tension line on the southern tip on the main section

Rorippa islandica — near foundations and old stone walls on the eastern side

Oxalis corniculata — scattered in upper grasslands on the larger section

Erodium cicutarium — rare, in the tension line on the east side of the larger section

Geranium robertianum — in the tension line on the eastern side of the larger section

Viola lanceolata — one specimen found on the edge of Tern Pond

Myriophyllum verticillatum — only in Tern Pond

Hedera helix — by the old foundations on the west side

Coelopleurum lucidum — near the marsh

Lycopus rubellus — near Dry Pond and along the edge of Tern Pond

Lycopersicum esculentum — scattered in grasslands and tension line on the east side of the larger section and near Tub Pond

Solanum dulcamara — common in the tension line and around old foundations and stone walls in the upland grasslands

Solanum villosum — in the tension line

Veronica arvensis — uncommon, scattered in tension line
Viburnum dentatum — near the old leprosarium foundations on the west side of the larger section
Cucurbita melo — one plant in a depression near Tub Pond
Aster novi-belgii — common around Typha Pond, on the hill behind the marsh and around the old foundations on the east side
Aster subulatus — edges of the marsh
Cirsium horridulum — scattered in grasslands
Lactuca canadensis — rare, on the causeway
Matricaria matricarioides — common in the tension line
Pluchea purpurascens — common in the marsh

Re-invasive species not collected since 1923:

Setaria lutescens — rare, near Typha Pond
Juncus greenei — common in grassy highlands
Polygonum persicaria — in Dry Pond
Amaranthus retroflexus — in the vicinity of Tub Pond
Portulaca oleracea — near leprosarium foundations
Arenaria peploides — in the beach on the eastern side of the larger section of the island
Spergularia marina — rare, in the beach and tension line on the eastern side of the larger section
Capsella bursa-pastoris — near old foundations on the eastern side of the larger section of the island
Vicia cracca — east shore around old stone walls
Lycopus americanus — near Typha Pond and depressions near Dry Pond
Anthemis cotula — scattered throughout the grasslands over the entire island
Helianthus annuus — one specimen on the causeway
Solidago juncea — not common, scattered in the grasslands behind the marsh and above the tension line
Taraxacum officinale — not common, found in upland grasslands on the larger section of the island

Re-invasive species not collected since 1873:

Digitaria sanguinalis — near Tern Pond, not common
Poa annua — scattered in grasslands on the north end of the larger section
Rumex obtusifolius — east side of the larger section in grasslands just above the tension line
Asclepias incarnata — rare, in grasslands
Gnaphalium uliginosum — rare, on the muddy border of Typha Pond

Species collected in 1947 but not in 1973:

Dryopteris thelypteris, Pinus sylvestris, Ruppia maritima, Andropogon scoparius, Avena sativa, Bromus commutatus, Panicum implicatum, Panicum oricola, Paspalum ciliatifolium, Spartina patens, Carex muhlenbergii, Carex silicea, Cyperus filiculmis, Eleocharis halophila, Eleocharis palustris, Eleocharis parvula, Scirpus americanus, Scirpus paludosus, Scirpus validus, Sisyrinchium angustifolium, Juncus bufonius, Juncus dichotomous, Populus deltoides, Salix pentandra, Quercus rubra, Rheum rhaponticum (Gleason, 1952), *Bassia hirsuta, Ranunculus cymbalaria, Barbarea vulgaris, Brassica juncea, Brassica kaber, Fragaria virginiana, Potentilla argentea, Potentilla egédei, Trifolium hybridum, Trifolium pratense, Vicia angustifolia, Vicia tetrasperma, Euphorbia polygonifolia, Parthenocissus quinquefolia, Parthenocissus tricuspidata, Hypericum mutilum, Kalmia angustifolia, Vaccinium atrococcum, Limosella subulata, Specularia perfoliata, Coreopsis lanceolata, Sonchus oleraceus.*

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